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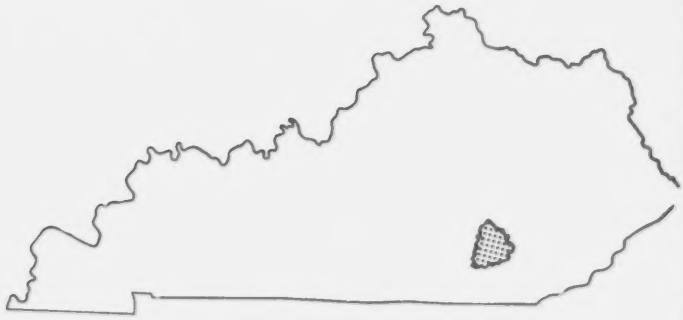
OCT 2 1990

FLOOD INSURANCE STUDY

LAUREL COUNTY, KENTUCKY

UNINCORPORATED AREAS



NOVEMBER 2, 1990

Federal Emergency Management Agency

COMMUNITY NUMBER - 210134

NOTICE TO
FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program have established repositories of flood hazard data for floodplain management and flood insurance purposes. This Flood Insurance Study may not contain all data available within the repository. It is advisable to contact the community repository for any additional data.

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FLOOD INSURANCE STUDY

LAUREL COUNTY,
UNINCORPORATED AREAS,
KENTUCKY

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the Unincorporated Areas of Laurel County, Kentucky, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study has developed flood risk data for various areas of the community that will be used to establish actuarial flood insurance rates and assist the community in its efforts to promote sound floodplain management. Minimum floodplain management requirements for participation in the National Flood Insurance Program are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

In some states or communities, floodplain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence and the State (or other jurisdictional agency) will be able to explain them.

1.2 Authority and Acknowledgments

The sources of authority for this Flood Insurance Study are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were performed by GRW Engineers, Inc., (the Study Contractor) for the Federal Emergency Management Agency (FEMA), under Contract No. EMW-87-C-2455. This study was completed in September 1988.

The hydrologic and hydraulic analysis for Lynn Camp Creek were taken from the Flood Insurance Study for Whitley County, Kentucky (Reference 1).

The hydrologic and hydraulic analysis for the Cumberland River/Lake Cumberland were taken from the Flood Insurance Study for Pulaski County, Kentucky (Reference 2).

1.3 Coordination

On October 22, 1986 an initial coordination meeting was held with representatives of FEMA, Laurel County, and the Study Contractor. Coordination with county officials and Federal, State, and regional agencies produced a variety of information pertaining to floodplain regulations, available community maps, flood history, and other hydrologic data.

On November 15, 1989, the results of this Flood Insurance Study were reviewed and accepted at a final coordination meeting attended by representatives of the Study Contractor, FEMA, and the community.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the unincorporated areas of Laurel County, Kentucky. The area of study is shown on the Vicinity Map (Figure 1). The incorporated areas within the county were excluded from this study.

Flooding caused by overflow of the Little Rockcastle River, Hazel Patch Creek, Lynn Camp Creek, and the Cumberland River/Lake Cumberland was studied in detail.

Areas having low development potential or minimal flood hazards were previously studied using approximate analyses. The results were shown on the Flood Hazard Boundary Map for Laurel County, Kentucky (Reference 3) and are incorporated into this Flood Insurance Study.

The areas studied were selected with priority given to all known flood hazard areas and areas of projected development or proposed construction through September 1993. The scope and methods of study were proposed to and agreed upon by FEMA and Laurel County.

2.2 Community Description

Laurel County is in the southeastern portion of Kentucky. Its county seat, London, is situated approximately 50 miles south of Lexington. The county is bordered by Rockcastle and Jackson Counties on the north, Clay County on the east, Knox, Whitley and McCreary Counties, and the City of Corbin on the south, and by Pulaski County on the west. Laurel County is served by Interstate 75, U.S. Route 25, and CSX railroad. It is comprised of approximately 446 square miles, with a 1980 population of 38,982 residents (Reference 4).

The climate in Laurel County is temperate, having moderately cold winters and warm, humid summers. Precipitation averages about 47 inches annually, and although it is fairly well distributed throughout the year, October generally has the least rainfall while March tends to have the most (Reference 5).

2.3 Principal Flood Problems

There are no gaging stations within close proximity of the study area. Therefore, historical analysis of flooding is limited. The U.S. Army Corps of Engineers (COE), Nashville District, generated a profile in 1964 for the Rockcastle River. From this data, the confluence of the Little Rockcastle River at the Rockcastle River had an elevation of about 875 feet for the June 1947 flood, the highest occurrence based on the data available.

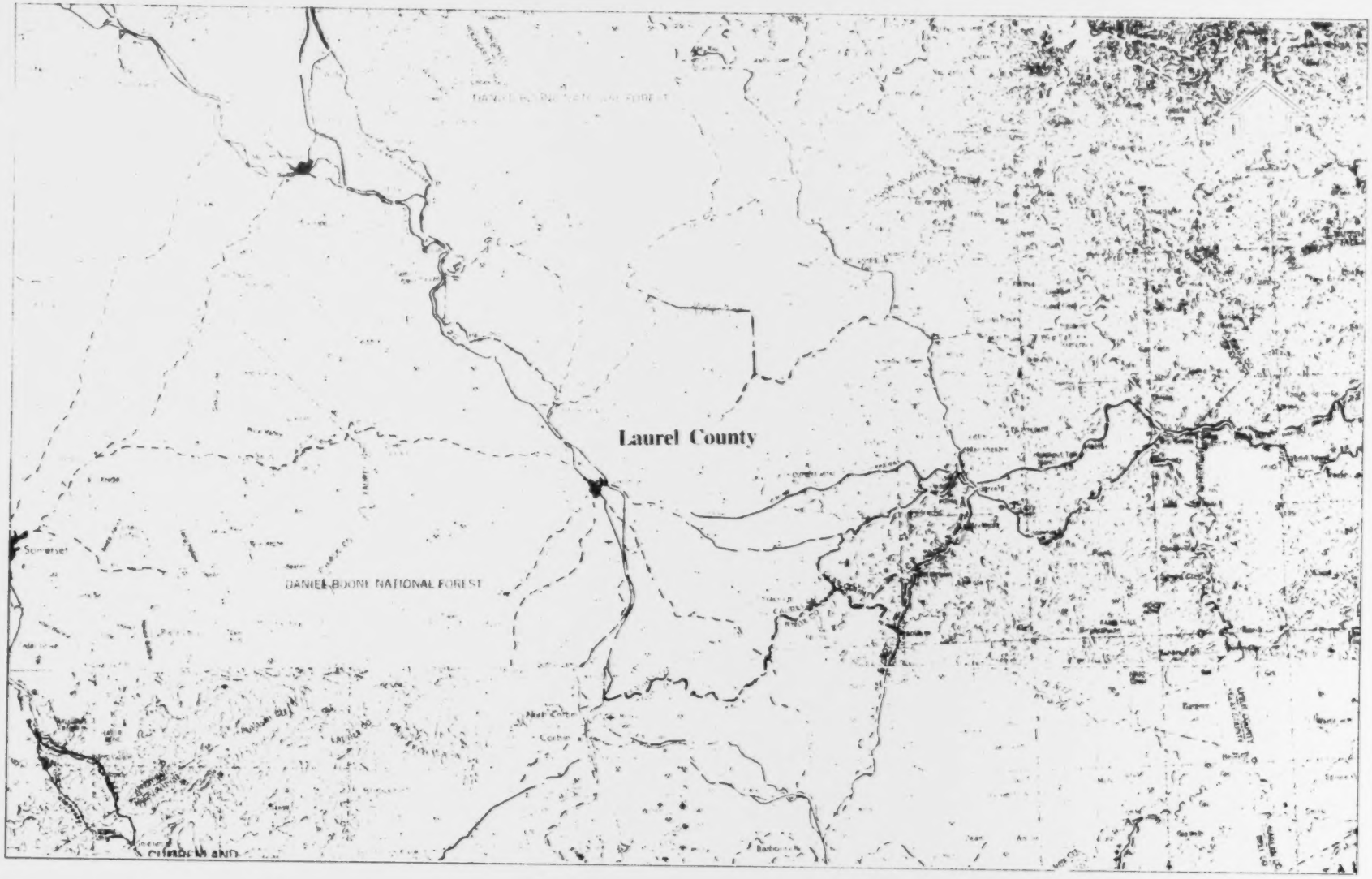

FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

LAUREL COUNTY, KY
(UNINCORPORATED AREAS)

APPROXIMATE SCALE

7 0 7 14 21 MILES

VICINITY MAP

However, the elevation was not used in the analysis for Laurel County. All elevations are referenced to the National Geodetic Vertical Datum of 1929 (NGVD).

During field reconnaissance, passers-by related that high water levels had overtopped the Hazel Patch Road bridge. In 1957, a flood on Lynn Camp Creek at U.S. Route 25W had an estimated elevation of 1,072.2 feet NGVD and a discharge of 9,000 cubic feet per second (cfs) (Reference 6).

2.4 Flood Protection Measures

Channel improvements on Lynn Camp Creek in the City of Corbin included the enlargement of the natural channel and the construction of a cutoff channel. This work was initiated as a result of the damage in Corbin caused by the 1957 flood. The resulting projected decrease of the 1957 flood profile and the intermediate regional flood profile elevations on Lynn Camp Creek at Corbin are shown in a COE report for Corbin (Reference 6).

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude that is expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for floodplain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10-, 2-, 1-, and 0.2-percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long-term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood that equals or exceeds the 100-year flood (1-percent chance of annual exceedence) in any 50-year period is approximately 40 percent (4 in 10), and, for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for each riverine flooding source studied in detail affecting the community.

The discharges for the Little Rockcastle River, and Hazel Patch Creek were determined by methods developed by U.S. Geological Survey (USGS) (Reference 7). These methods enabled the determination of the 10-, 50-, and 100-year discharges of each stream, and from these three values a 500-year discharge was calculated through a regression analysis of the discharge vs. log-of-return-interval relationship.

The discharge for Lynn Camp Creek was established using available runoff records and computed floodflows.

Peak discharge-drainage area relationships for the 10-, 50-, 100-, and 500-year floods of each flooding source studied in detail in the community are shown in Table 1.

TABLE 1 - SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (SQ MILES)	PEAK DISCHARGE (CFS) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
LITTLE ROCKCASTLE RIVER					
at mouth	56.2	5,060	7,294	8,283	10,550
just downstream of confluence of Wood Creek	52.6	4,838	6,981	7,929	10,050
HAZEL PATCH CREEK just upstream of confluence of Wood Creek	27.2	3,096	4,508	5,134	6,550
LYNN CAMP CREEK at East Masters Street	53.8	N/A	N/A	10,800	N/A

The elevations for the 100-year flood on the Lake Cumberland portion of the Cumberland River was provided by the Nashville District COE and is shown in Table 2.

TABLE 2 - SUMMARY OF ELEVATIONS

FLOODING SOURCE AND LOCATION	PEAK ELEVATION (FEET NGVD) 100-YEAR
LAKE CUMBERLAND/ CUMBERLAND RIVER within community	749.8

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals.

Cross sections, bridge sections, and culvert sections were obtained from field surveys and aerial photography.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles and on the Flood Insurance Rate Map.

Channel roughness coefficients (Manning's "n") used in hydraulic computations for Little Rockcastle River and Hazel Patch Creek were chosen by engineering judgment and based on field observations of the streams and floodplain areas. A roughness value of 0.07 was used for the channel and 0.075 was used for the floodplain areas.

Roughness values for Lynn Camp Creek were obtained from field surveys and adjusted based on stereo photographs and USGS Water Supply Paper 1849 (Reference 8). Roughness values ranged from 0.035 to 0.07 for the channel and from 0.07 to 0.28 for the overbank areas.

Water-surface elevations of floods of the selected recurrence intervals for Little Rockcastle River and Hazel Patch Creek were computed through the use of the HEC-2 step-backwater computer program (Reference 9). The starting water-surface elevations were calculated using the slope-area method. The elevations do not include the effect of backwater from the Rockcastle River.

The HEC-2 and WSPRO computer programs (References 9 and 10) were used to compute the 100-year water-surface elevations for Lynn Camp Creek. The starting water-surface elevation was determined using backwater calculations.

Flood profiles were drawn showing the computed water-surface elevations for floods of the selected recurrence intervals. In cases where the 50- and 100-year flood elevations are close together, due to limitations of the profile scale, only the 100-year profile has been shown.

The hydraulic analyses for this study are based on the effects of unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

Elevation reference marks used in this study are shown on the map and described in the exhibit labeled Elevation Reference Marks.

4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

The National Flood Insurance Program encourages state and local governments to adopt sound floodplain management programs. Therefore, each Flood Insurance Study provides 100-year flood elevations and delineations of the 100- and 500-year floodplain boundaries and 100-year floodway to assist communities in developing floodplain management measures.

4.1 Floodplain Boundaries

To provide a national standard without regional discrimination, the 1-percent annual chance (100-year) flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2-percent annual

chance (500-year) flood is employed to indicate additional areas of flood risk in the community. For each stream studied in detail, the 100- and 500-year floodplain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using topographic maps at a scale of 1:24000 with a contour interval of 20 feet (Reference 11).

The 100- and 500-year floodplain boundaries are shown on the Flood Insurance Rate Map. On this map, the 100-year floodplain boundary corresponds to the boundary of the areas of special flood hazards (Zones A, AE, AH, AO, A99, V, and VE) and the 500-year floodplain boundary corresponds to the boundary of areas of moderate flood hazards. In cases where the 100- and 500-year floodplain boundaries are close together, only the 100-year floodplain boundary has been shown. Small areas within the floodplain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

For the streams studied by approximate methods, only the 100-year floodplain boundary was delineated using the Flood Hazard Boundary Map for Laurel County (Reference 3).

4.2 Floodways

Encroachment on floodplains, such as structures and fill, reduces the flood-carrying capacity, increases the flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of floodplain management involves balancing the economic gain from floodplain development against the resulting increase in flood hazard. For purposes of the National Flood Insurance Program, a floodway is used as a tool to assist local communities in this aspect of floodplain management. Under this concept, the area of the 100-year floodplain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 100-year flood can be carried without substantial increases in flood heights. Minimum Federal standards limit such increases to 1.0 foot, provided that hazardous velocities are not produced. The floodways in this study are presented to local agencies as minimum standards that can be adopted directly or that can be used as a basis for additional floodway studies.

The floodways for this study were computed for certain stream segments on the basis of equal conveyance reduction from each side of the floodplain. Floodway widths were computed at cross sections. Between cross sections, the floodway boundaries were interpolated. The results of the floodway computations are tabulated for selected cross sections and are shown in Table 3, Floodway Data. The computed floodways are shown on the Flood Insurance Rate Map. In cases where the floodway and 100-year floodplain boundaries are either close together or collinear, only the floodway boundary is shown.

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC.)	REGULATORY (FEET NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE (FEET)
LITTLE ROCKCASTLE RIVER								
A	580	198	3202	2.6	856.9	856.9	857.9	1.0
B	2730	167	2331	3.6	858.1	858.1	859.1	1.0
C	6530	133	1797	4.6	862.4	862.4	863.4	1.0
D	10,180	395	3176	2.6	866.2	866.2	867.1	0.9
HAZEL PATCH CREEK								
E	13,930	183	2087	2.5	869.2	869.2	870.0	0.8

[1]FEET ABOVE CONFLUENCE WITH ROCKCASTLE RIVER

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

LAUREL COUNTY, KY
(UNINCORPORATED AREAS)

FLOODWAY DATA

LITTLE ROCKCASTLE RIVER / HAZEL PATCH CREEK

Along streams where floodways have not been computed, the community must ensure that the cumulative effect of development in the floodplain will not cause more than 1.0-foot increase in the base flood elevations at any point within the community.

The area between the floodway and the 100-year floodplain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the floodplain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood by more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to floodplain development are shown in Figure 2.

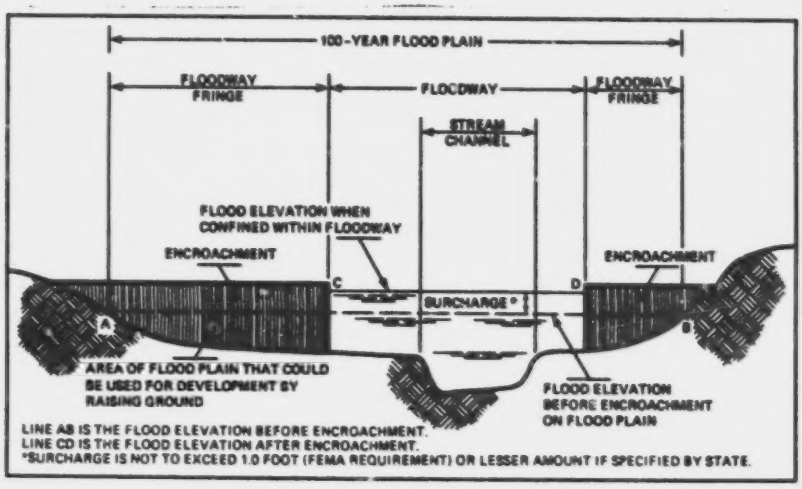
100-YEAR FLOOD PLAIN
FLOODWAY FRINGE
FLOODWAY
FLOODWAY FRINGE
STREAM CHANNEL
FLOOD ELEVATION WHEN CONFINED WITHIN FLOODWAY
ENCROACHMENT
ENCROACHMENT
C
D
SURCHARGE *
A
B
AREA OF FLOOD PLAIN THAT COULD BE USED FOR DEVELOPMENT BY RAISING GROUND
FLOOD ELEVATION BEFORE ENCROACHMENT ON FLOOD PLAIN
LINE AB IS THE FLOOD ELEVATION BEFORE ENCROACHMENT.
LINE CD IS THE FLOOD ELEVATION AFTER ENCROACHMENT.
*SURCHARGE IS NOT TO EXCEED 1.0 FOOT (FEMA REQUIREMENT) OR LESSER AMOUNT IF SPECIFIED BY STATE.

FIGURE 2 - Floodway Schematic

5.0 INSURANCE APPLICATION

For flood insurance rating purposes, flood insurance zone designations are assigned to a community based on the results of the engineering analyses. These zones are as follows:

Zone A

Zone A is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no base flood elevations or depths are shown within this zone.

Zone AE

Zone AE is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by detailed methods.

Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone X

Zone X is the flood insurance rate zone that corresponds to areas outside the 100-year floodplain, areas of 100-year flooding where average depths are less than 1 foot, areas of 100-year flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 100-year flood by levees. No base flood elevations or depths are shown within this zone.

6.0 FLOOD INSURANCE RATE MAP

The Flood Insurance Rate Map is designed for flood insurance and floodplain management applications.

For flood insurance applications, the map designates flood insurance rate zones as described in Section 5.0 and, in the 100-year floodplains that were studied by detailed methods, shows selected whole-foot base flood elevations or average depths. Insurance agents use the zones and base flood elevations in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.

For floodplain management applications, the map shows by tints, screens, and symbols the 100- and 500-year floodplains, the floodways, and the locations of selected cross sections used in the hydraulic analyses and floodway computations.

7.0 OTHER STUDIES

Flood Insurance Studies published for Whitley and Knox Counties, and the City of Corbin, Kentucky (References 1, 12, and 13) are in agreement with this study.

Flood Insurance Rate Maps printed for Clay and Jackson Counties, Kentucky (References 14 and 15) are in agreement with this study.

The Flood Insurance Study in progress for Pulaski County, Kentucky (Reference 2) is in agreement with this study.

This Flood Insurance Study supersedes the previously printed Flood Hazard Boundary Map for Laurel County, Kentucky (Reference 3).

8.0 LOCATION OF DATA

Information concerning the pertinent data used in the preparation of this study can be obtained by contacting the Natural and Technological Hazards Division, FEMA, 1371 Peachtree Street, NE., Suite 736, Atlanta, Georgia 30309.

Future revisions may be made that do not result in the republishing of the Flood Insurance Study report. To assure that any user is aware of all revisions, it is advisable to contact the map repository of flood hazard data located in the community.

9.0 REFERENCES AND BIBLIOGRAPHY

1. Federal Emergency Management Agency, Flood Insurance Study, Whitley County, and Incorporated Areas, Kentucky, January 1989.

2. ————, Flood Insurance Study, Pulaski County, Unincorporated Areas, Kentucky, in progress.

3. U.S. Department of Housing and Urban Development, Federal Insurance Administration, Flood Hazard Boundary Map, Laurel County, Unincorporated Areas, Kentucky, November 1977.

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6. U.S. Army Corps of Engineers, Nashville District, "Flood Plain Information Report, Lynn Camp and East Fork Lynn Camp Creeks," Corbin, Kentucky, May 1974.

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8. ————, Water Supply Paper 1849, Roughness Characteristics of Natural Channels, H.H. Barnes, Jr., 1967.

9. U.S. Army Corps of Engineers, Hydrologic Engineering Center, HEC-2 Water Surface Profiles, Computer Program 723-X6-L202A, Davis, California, April 1984.

10. U.S. Department of Transportation, Federal Highway Administration, Report No. FHWA/RD-86/108, Bridge Waterways Analysis Model: Research Report, J.O. Shearman, W.H. Kirby, V.R. Snyder, and H.N. Flippo, July 1986.

11. U.S. Geological Survey, 7.5 Minute Series Topographic Maps, Scale 1:24000, Contour Interval 20 Feet: Bernstadt, Kentucky, 1969; Livingston, Kentucky, 1969; London, Kentucky, 1969; Parrot, Kentucky, 1953; Sawyer, Kentucky, 1952; Corbin, Kentucky, 1970.

12. Federal Emergency Management Agency, Flood Insurance Study, Knox County, Unincorporated Areas, Kentucky, May 1989.

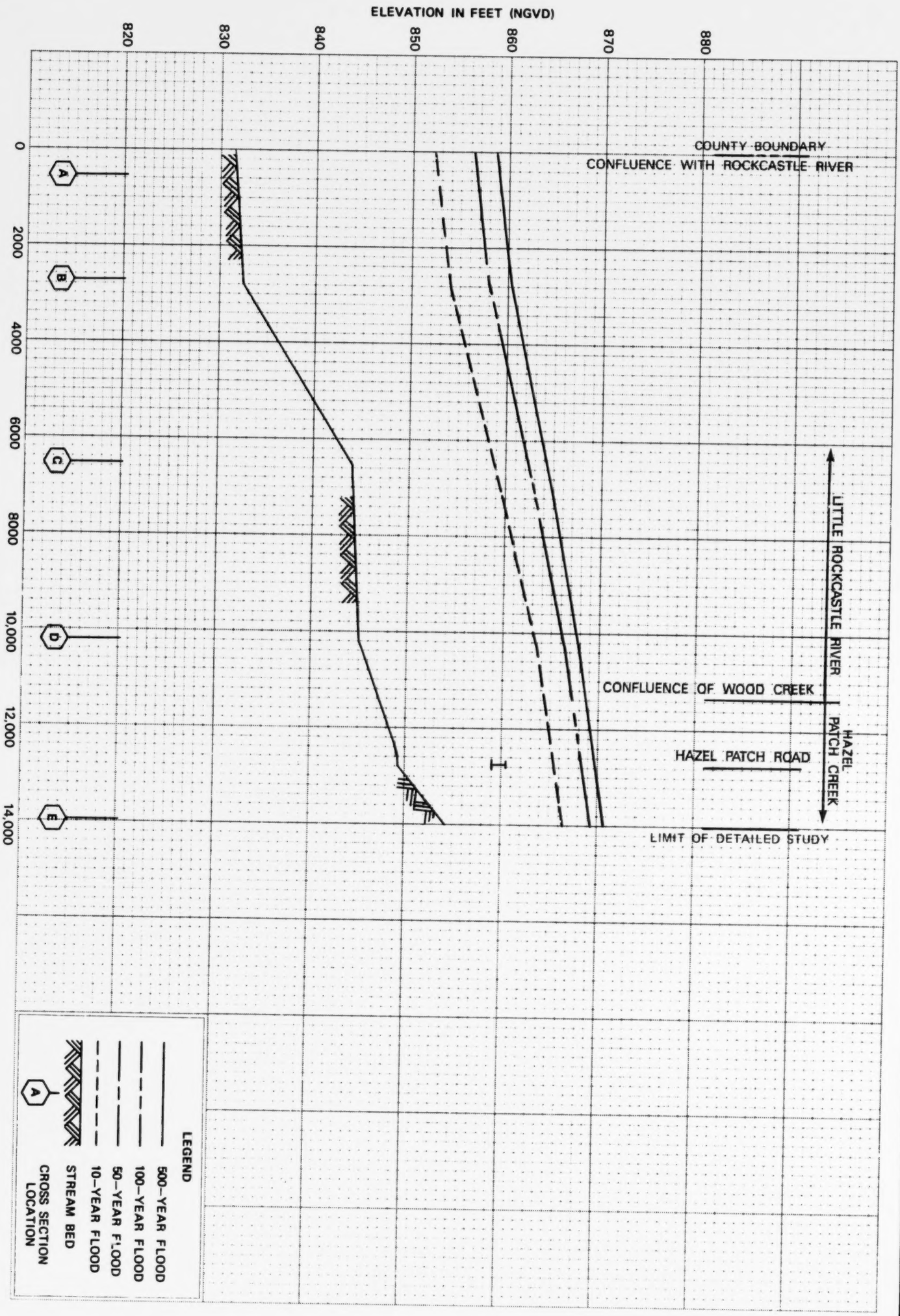
13. ----------, Flood Insurance Study, City of Corbin, Knox and Whitley Counties, Kentucky, December 1986.

14. ————, Flood Insurance Rate Map, Clay County, Unincorporated Areas, Kentucky, January, 1987.

15. ————, Flood Insurance Rate Map, Jackson County, Unincorporated Areas, Kentucky, July 1987.

ELEVATION REFERENCE MARKS

REFERENCE MARK	FLOOD INSURANCE RATE MAP PANEL	ELEVATION (FEET NGVD)	DESCRIPTION OF LOCATION
1	0015	879.52	hub and tack located about 8,500 feet northwest along CSX railroad from intersection of CSX railroad and Hazel Patch Road
2	0015	855.22	hub and tack located about 350 feet south and 100 feet east of west end of CSX railroad tunnel No. 6
3	0015	877.09	PK nail in power pole located about 3,650 feet northwest on CSX railroad right-of-way from intersection of CSX railroad and Hazel Patch Road
4	0015	872.42	PK nail in power pole located about 150 feet northwest along CSX railroad from interseaction of CSX railroad and Hazel Patch Road
5	0015	873.91	hub and tack located about 100 feet south of CSX railroad, about 1,000 feet east along CSX railroad from intersection of CSX railroad and Hazel Patch Road
6	0015	874.58	hub and tack located about 1,850 feet east along CSX railroad from intersection of CSX railroad and Hazel Patch Road
7	0015	885.385	brass disc set vertically in north face of outcropping of rock located 95 feet west of west end of south track of CSX railroad tunnel No. 6
8	0015	1,003.430	brass disc set vertically in face of rock cut located about 800 feet northwest along U.S. Route 25 from northwest end of a fill over Wood Creek



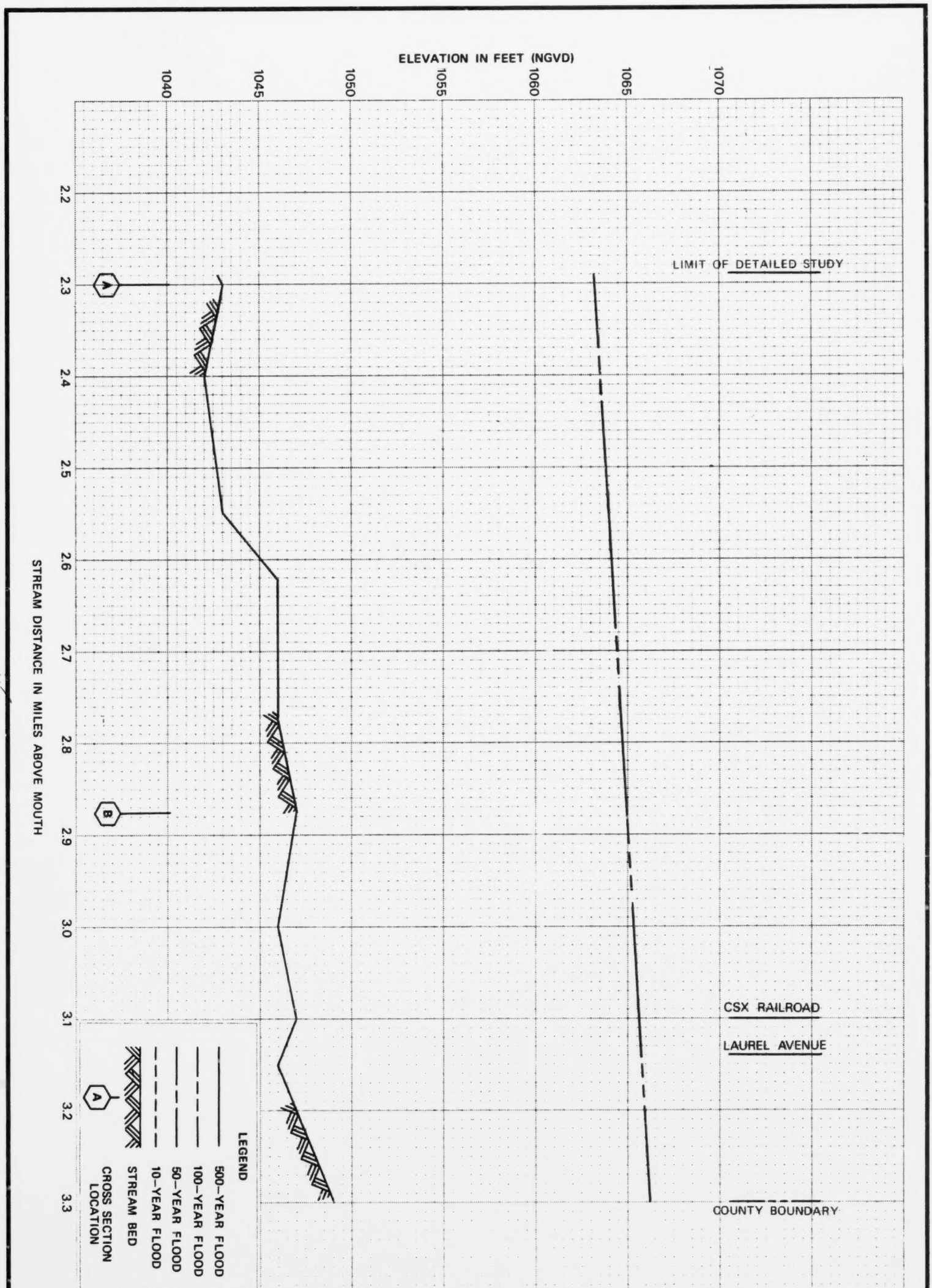
FEDERAL EMERGENCY MANAGEMENT AGENCY

LAUREL COUNTY, KY
(UNINCORPORATED AREAS)

FLOOD PROFILES

LITTLE ROCKCASTLE RIVER/HAZEL PATCH CREEK

01P



02P

FEDERAL EMERGENCY MANAGEMENT AGENCY

LAUREL COUNTY, KY
(UNINCORPORATED AREAS)

FLOOD PROFILES

LYNN CAMP CREEK